REMARKS

Claims 50-53 and 55-70 are pending. By this Amendment, claim 54 is canceled as being a duplicate of claim 53; claims 50, 55 and 56 are amended; and new claims 59-70 are added. The specification is amended to update the status of the incorporated applications and to address several minor informalities. Reconsideration of the November 9, 2001 Official Action is respectfully requested.

Rejection

The Official Action rejects claims 50-58 under 35 U.S.C. § 102(a) over U.S. Patent No. 6,070,551 to Li et al. ("Li"). Claim 54 has been canceled. The rejection is respectfully traversed for the following reasons.

Claim 50 recites an inductively coupled plasma processing system, which comprises "a substrate holder supporting a substrate within said processing chamber" and "means for maintaining the substrate holder at a temperature of about 80°C to 200°C during deposition of a material on the substrate by plasma-enhanced chemical vapor deposition." Li does not disclose the combination of features recited in claim 50.

Li discloses a deposition chamber, which is shown in Fig. 3. The deposition chamber includes a substrate support 14 that supports a substrate 20 in chamber 18. The Official Action states at page 2, paragraph 2, that in Li "[o]perating temperatures of the chamber are eluded (sic) to: '. . . (substantially no HF or H_2O outgassing at temperatures up to 450°C) . . .' (col. 5, lines 54-56)" (emphasis added). However, this description merely discloses that some temperature may be up to 450°C somewhere in Li's apparatus.

Claim 50 recites "means for maintaining the substrate holder at a temperature of about 80°C to 200°C during deposition of a material on the substrate by plasma-enhanced chemical vapor deposition." In contrast, Li does not disclose the temperature at which the substrate support 14 is maintained at any time during operation of Li's apparatus. Accordingly, Li does not disclose the "means for maintaining" recited in claim 50. Li thus does not disclose the combination of features recited in claim 50.

The Official Action further states that "[i]n advance, it is generally accepted that apparatus claims must be distinguished from the prior art in terms of structure rather than function or the products produced so long as the prior art apparatus is capable of such operation and products. See MPEP 2114." However, the Official Action does not allege that any particular language in the claims is "functional." Accordingly, Applicants cannot respond to any specific allegations regarding the recitation of functional language in the claims. However, it is still improper for the Patent Office to fail to give weight to any functional feature recited in a claim. As stated in MPEP § 2173.05(g), "a functional feature must be evaluated and considered, just like any other limitation of the claim, for what it fairly conveys to a person of ordinary skill in the pertinent art in the context in which it is used" (emphasis added). Thus, it is improper for the Patent Office to not give consideration to a limitation in a apparatus claim, even if that limitation is "functional." Functional features, like structural features, can be relied on to distinguish a claimed invention over the art.

Accordingly, because Li does not disclose each and every feature recited in claim 50, claim 50 is patentable over Li. Claims 51-53 and 55-58 depend from claim 50 and,

thus, are also patentable over Li. Therefore, Applicants respectfully request that the rejection be withdrawn.

New Claims

New claims 59-70 have been added. Claims 59-64 depend from claim 50. Support for claim 59 can be found at page 6, lines 12-13 of the specification. Support for claims 60 and 61 can be found at page 11, line 23 to page 12, line 8 of the specification. Support for claim 62 can be found at page 12, line 9 to page 13, line 12 of the specification. Support for claim 63 can be found at page 13, lines 13-17 of the specification. Support for claim 64 can be found at page 12, lines 22-24 of the specification. Dependent claims 59-64 are thus also deemed allowable.

Independent claim 65 recites an inductively coupled plasma processing system, which comprises "a substrate support supporting a substrate within the processing chamber"; "an electrode operable to heat the substrate support"; and "the electrode is maintained at a temperature of about 80°C to 200°C during deposition of a material on the substrate by plasma-enhanced chemical vapor deposition." Claim 65 is deemed to be allowable for reasons stated above.

Dependent claims 66-70 are thus also deemed allowable.

In view of the foregoing, it is respectfully submitted that the present application is in condition for allowance and such action is earnestly solicited.

Respectfully submitted,

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Page 6, Paragraph Beginning at Line 3

FIG. 1 shows a ICP reactor 20 which can process substrates with high density plasma. Suitable ICP reactors include TCP™ systems from [LAM] Lam Research Corp., Fremont, CA. See also Ogle, U.S. Patent No. 4,948,458 which is hereby incorporated by reference herein. The reactor includes a process chamber 21 in which plasma 22 is generated adjacent substrate 23. The substrate is supported on water cooled substrate support 24 and temperature control of the substrate is achieved by supplying helium gas through conduit 25 to a space between the substrate and the substrate support. The substrate support can comprise an anodized aluminum electrode, which may be heated, or a ceramic material having a buried electrode therein, the electrode being powered by an RF source 26 and associated circuitry 27 for providing RF matching, etc. The temperature of the substrate during processing thereof is monitored by temperature monitoring equipment 28 attached to temperature probe 29.

Page 7, Paragraph Beginning at Line 14

Reactor 20 can be used to carry out the gap filling process of the invention wherein a heavy noble gas is used to increase the etch-to-deposition rate ratio (EDR) for void-free filling of sub 0.5 μm high aspect ratio gaps. Gap filling processes are further described in

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[copending application Serial No. 08/623,825 filed on March 29, 1996 entitled "IMPROVED METHOD OF HIGH DENSITY PLASMA CVD GAP-FILLING,"] U.S. Patent No. 6,106,678 which [application] is hereby incorporated by reference herein. The heavy noble gas is effective in sputtering corners of sidewalls of the gaps such that the corners are facetted at an angle of about 45 degrees. The noble gas has a low ionization potential and forms massive ions which enhance the sputtering rate at a given RF power relative to the deposition rate, thus reducing the power required to fill a given gap structure. Moreover, the low ionization potential of the noble gas helps spread plasma generation and ion bombardment more uniformly across the substrate. As xenon is the heaviest of the non-reactive noble gasses, xenon is preferred as the noble gas. Krypton can also be used even though it has a lower mass and higher ionization potential than xenon. Argon is also suitable as the noble gas. Preferably, the amount of noble gas added is effective to provide a sputter etch component with a magnitude on the order of the deposition rate such that the etch to deposition rate ratio is preferably about 5% to 70%, and more preferably about 10% to 40%.

Page 8, Paragraph Beginning at Line 19

In order to prevent damage to metal lines or the pre-existing films and structures on the substrate and to ensure accurate and precise process control, a heated mechanical or preferably an electrostatic chuck (ESC) is employed to hold the substrate. The ESC is

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preferably bipolar or monopolar. Preferably, the electrode is maintained at a temperature ranging from about 50°C to 350°C, in order to maintain the temperature of the wafer to about 325°C to 375°C. The preferred electrode temperature will depend on, among other things, the RF bias level and the particular deposition step. For example, during the gap-fill process, the electrode temperature is preferably maintained between about 80°C (full bias) to 200°C (no bias). Similarly, during the capping process, the electrode temperature is preferably maintained at between about 125°C (full bias) to 350°C (no bias). The gap-[fulling] filling and capping processes are described herein. A suitable chuck for temperature control is disclosed in [copending application serial number _____, filed on September 30, 1996, entitled "VARIABLE HIGH TEMPERATURE CHUCK FOR HIGH DENSITY PLASMA CHEMICAL VAPOR DEPOSITION", by Brian McMillin] U.S. Patent No. 5,835,334, which is hereby incorporated by reference herein.

Page 10, Paragraph Beginning at Line 27

It has been demonstrated that for high density PECVD, improved deposition rate and uniformity can be achieved by employing a gas distribution system which provides uniform, high flow rate delivery of reactant gases onto the substrate surface, to both increase the deposition rate and to minimize the chamber cleaning requirements. A

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suitable gas distribution system is disclosed in [copending application serial number 08/672,315, filed on June 28, 1996, entitled "FOCUSED AND THERMALLY CONTROLLED PLASMA PROCESSING SYSTEM AND METHOD FOR HIGH DENSITY PLASMA CHEMICAL VAPOR DEPOSITION OF DIELECTRIC FILMS," by Brian McMillin et al.] U.S. Patent No. 6,270,862, which [application] is hereby incorporated by reference herein.

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Marked-up Claims 50, 55 and 56

50. (Amended) An inductively coupled plasma processing system, comprising:

a plasma processing chamber;

a substrate holder supporting a substrate within said processing chamber [wherein the substrate holder is at a temperature of about 80°C to 200°C];

an electrically-conductive coil disposed outside said processing chamber;

means for introducing a process gas into said processing chamber; [and]

an RF energy source which inductively couples RF energy into the processing chamber to energize the process gas into a plasma state, and

means for maintaining the substrate holder at a temperature of about 80°C to 200°C during deposition of a material on the substrate by plasma-enhanced chemical vapor deposition.

55. (Amended) The system of Claim 50, wherein the process chamber is a vacuum chamber maintained at about 1 mTorr to about 30 mTorr.

56. (Amended) The system of Claim 56, wherein the system further comprises an electrode within the substrate holder [a further comprising] and an RF generator [that is] connected to the [substrate produces an RF bias] electrode.